TEXAS HIGHWAY DEPARTMENT

Construction & Maintenance

BULLETIN No. 15

Sept. 1952

Asphalt Spreader

Foreword

This bulletin is published for the purpose of presenting practical information applicable to current highway problems. These conclusions and data are not necessarily endorsed by the Highway Department nor are they to be construed as instructions. Employees are invited and urged to submit suggestions and relate experiences which would benefit those engaged in the construction and maintenance of highways.

Photographic services are available and other assistance may be obtained if desired in preparing material for submission. All material and comments should be directed to the Chief Engineer, Construction & Maintenance, Austin, Texas.

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Maintenance Division	D- 3
Equipment & Procurement Division	D- 4
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TEXAS HIGHWAY DEPARTMENT
AUSTIN 14, TEXAS

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As We See It

There is one simple and safe rule to follow when driving a Highway vehicle. This applies to any man, or woman, we meet at a traffic corner or along the highway.

The simple rule is to assume that to this man, or woman, you are the Highway Department and your actions reflect for good or bad on the whole Department and not just your part of the Department.

How many of us realize that when we blow our horn in a discourteous way at the car in front of us, or give the driver a scowl in passing, we may be tearing down in one instant years of good will that many have worked hard to obtain?

It is also, reasonable to assume that you will meet the man again next day, or next week, or will sometime run into him under more intimate circumstances or conditions where any act of discourtesy would be embarrasing on the second meeting.

The caption for this simple little rule could be: "Safety in Courtesy.'"

Your

Materials and Tests Laboratory

K.K. Moore, Senior Paint Engineer
Materials and Tests Division

Consumption of road marking paint by the 48 states in 1950 was in excess of 2,000,000 gallons.[1] *Although acceptance of the practice of designating traffic lanes by paint stripes has shown steady growth since its introduction fifty years ago in Wayne County, Michigan,*[2] *a recent survey showed that the majority of highway engineers feel that paints of still better service life are needed.*[1]

To acquaint you with the facilities available at the Materials and Tests Laboratory for the improvement of traffic paints, we invite you to review briefly our procedure for the development of a paint to be used for traffic stripes.

The Materials and Tests Laboratory sincerely desires that no opportunity be lost to be of service to the field. To enable you to obtain the maximum benefits from your Laboratory, we begin in this issue a series of articles which are intended to acquaint you with the services and facilities which are available at the Materials and Tests Laboratory.

In this, the first article, we invite you to follow the development of a paint to be used for traffic stripes.

A few years ago the choice of raw materials to be used in a paint was easy, as these raw materials were limited to linseed oil, natural gums or resins, white lead, and natural earth oxides. The transition of paint making from an art to a science has been accompanied by the introduction of new raw materials, until today the choice of components for a paint is a study of compromise. For example, a varnish with the fast drying time necessary for traffic paint will often yield a brittle film, while the introduction of plasticizers necessary to soften this brittle film will slow down the dry. To further complicate the balancing of these contradictory physical properties of paint ingredients is the ever-present factor of cost.

Once the components of the formulation are chosen, they are ground into paint on a ball mill or on a roller mill. These mills are the same as those that will be used in the commercial manufacture of the paint, except for their size.

While no accelerated tests have yet been devised that will predict the actual service life of paints, there are many tests which, when coupled with experience and a knowledge of the chemistry involved, will render valuable information regarding performance that can be expected from a paint. In addition to the regular routine tests for paint, such as a test for viscosity, paints made in the laboratory are subjected to artificial weathering in a weatherometer and to simulated traffic on our "merry-go-round."

From the results of these tests the best formulation is chosen, and after the color and general characteristics of the paint are approved by the Traffic Services Division, a specification is written that will assure that the paint purchased has the desired characteristics. In an attempt to be fair to all paint manufacturers, this specification is drawn with as exact terms as is possible. Phrases such as "good material" or "manufactured according to good practice" are avoided because they do direct injury to the competent, ethical manufacturer by placing no restrictions on unscrupulous quality cutting competition.

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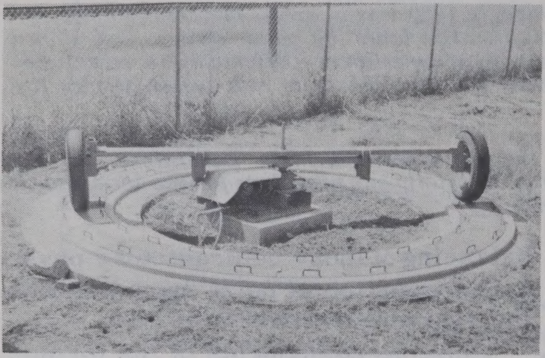
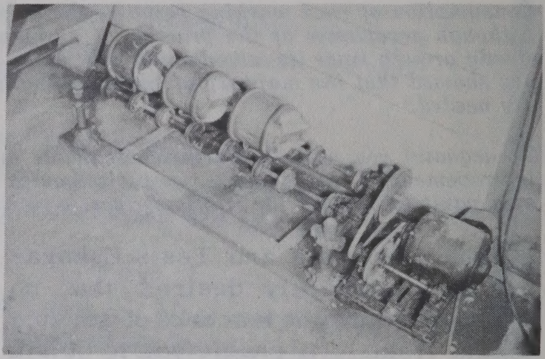
[1] *Survey by the New Jersey Zinc Sales Co.*

[2] *"Edward N. Hines, Father of the Center Traffic Line," Roads & Streets, Col. 79 p. 52 (Dec. 1936)*

The Laboratory's responsibility does not end with the writing of the specifications. The paint section supervises the manufacture of the paint to be sure that it complies with the specification, and then checks the actual application of the paint and its service life in the field in an effort to secure information that will be of value in developing an improved traffic paint for the next year's striping program.



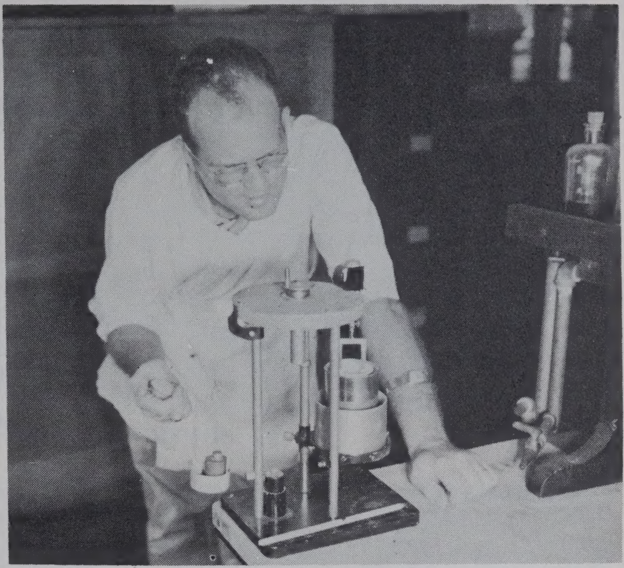
Circular Track - used to simulate traffic over traffic stripes.



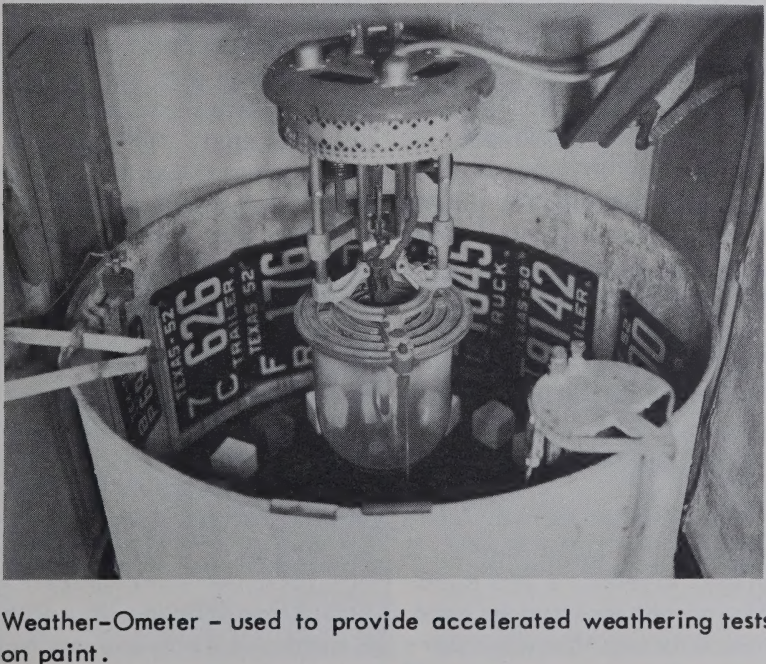
Laboratory Ball Mill (Pebble Mill) for grinding small quantities of paint.

Raw Material Shelf - a few of the raw materials used in formulation of paint.

Laboratory Roller Mill for grinding small quantities of paint.



Viscosimeter – for determining viscosity (thickness) of paint.



Weather-Ometer – used to provide accelerated weathering tests on paint.

Hardfacing - - Keeps Equipment On The Job

G.L. Wiley, Welding Specialist
Equipment and Procurement Division

Hardfacing is an easy and economical way to keep equipment on the job with less "time-out" for repairing or replacing worn parts. It reduces costs in a number of ways, some of which are direct and obvious. Others, however, involve "hidden" costs -- factors that definitely contribute to the over-all cost of keeping equipment in operation, yet are often overlooked when the economy of hardfacing a part is being considered.

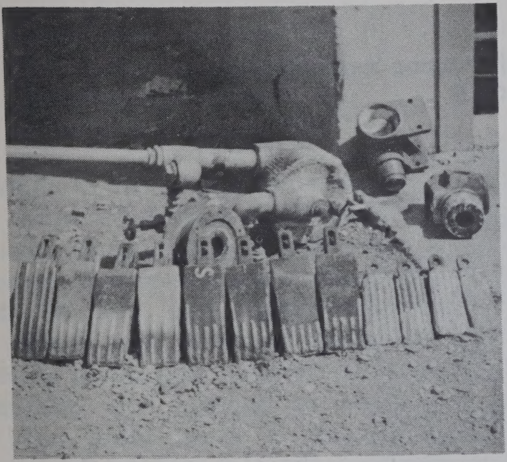
A part that has been carefully hardfaced with the right alloy has a longer service life than an unprotected part. Depending upon the alloy used and the service conditions to which the part is subjected, hardfaced surfaces will outwear unprotected surfaces from two to 25 times and more. With this increased life, numerous replacements and costly down times are avoided.

Hardfacing is often the answer when parts must be both hard and tough. It is well known that toughness and hardness of metals do not go hand in hand. A compromise between these properties must generally be accepted. If parts are designed for hardfacing, the bulky body or parent metal can be a plain carbon steel that has adequate strength and shock resistance for the job. Then the wearing surfaces can be faced with a suitable wear-resistant material at low cost, providing a composite part that is both strong and hard.

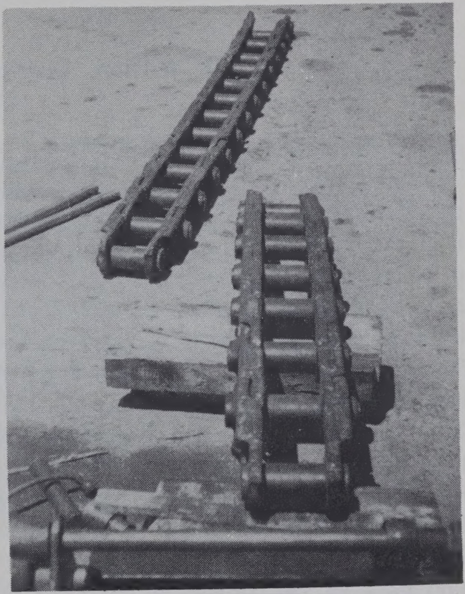
Many parts that were formerly sent to the scrap pile can be hardfaced and put back into service for less than their original cost. This saving multiplies because parts can be rebuilt again and again when necessary. For this reason, you can cut down stocks of new parts kept on hand for emergency and general replacements.

Still another saving, but one that is difficult to evaluate in actual dollars and cents on most jobs, is in the fact that hardfaced parts remain in better condition. When a part begins to wear, its effectiveness as an individual producing unit is usually lowered. The output and efficiency of the equipment in which the part operates are at the same time decreased, and more power is needed to drive the machine in order to get the same or poorer operating performance.

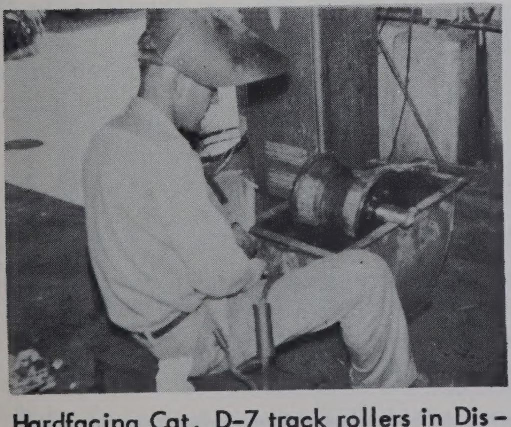
Building up track treads - District 23.



Various types of teeth hardfaced by District 7.



Part of complete track links hardfaced in District 24.



Hardfacing Cat. D-7 track rollers in District 23.

Scarifier teeth and others hardfaced by District 14.

Gravel Spreader Box

IMPROVED

J.D. Willson, District Maintenance Superintendent
DISTRICT 5

The three photographs show a gravel spreader box developed in this District. The idea for this device originated in the Lamb County Section several years ago, and the first one built was of wood. Then some salvage bridge-tread steel was obtained and a box was built of steel, shown in Picture 1. These first two types of boxes were used to scoop gravel out of in making skin or seal patches. The box permits a man to shovel from a comfortable height without having to remove the end gate of the truck.

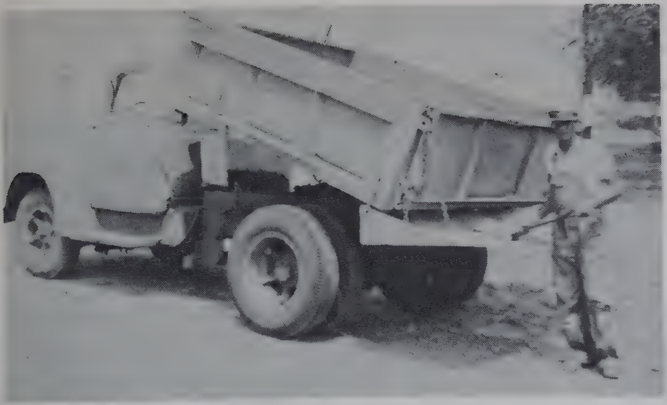
Picture 2 shows an improvement made recently which consists of a slot in the bottom of the box and a sliding gate activated by a lever so arranged that the truck driver can operate it with a rope if desired. This type works very well when sealing narrow strips. The 40-inch slot permits the truck to cover a narrow application of asphalt with gravel while moving forward.

Picture 3 shows the most recent development which is a slot almost eight feet long. The use of this arrangement permits the truck to operate in reverse and cover a wide application of asphalt. If desired, loose pieces of steel plate can be placed over the slot making the opening any length wanted.

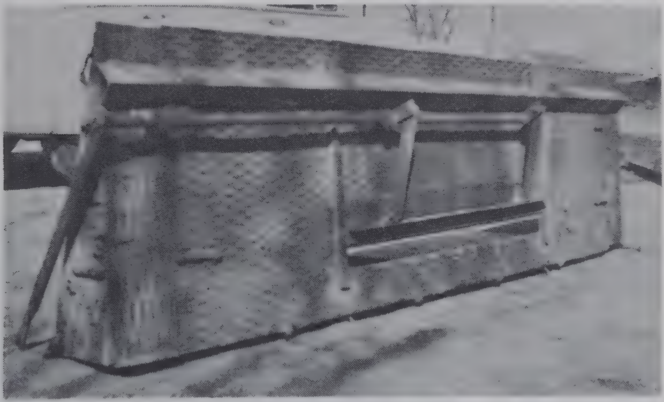
This box is being used throughout District 5 and is very simple and effective. It can be made from scrap material at a cost of approximately $20.

Credit for the idea and development of this spreader box should go to Mr. H. C. Edmonds, Maintenance Foreman, Mr. Jesse McClanahan, Skilled Laborer, and Mr. L. F. Foley, Semi-skilled Laborer, all of Littlefield.

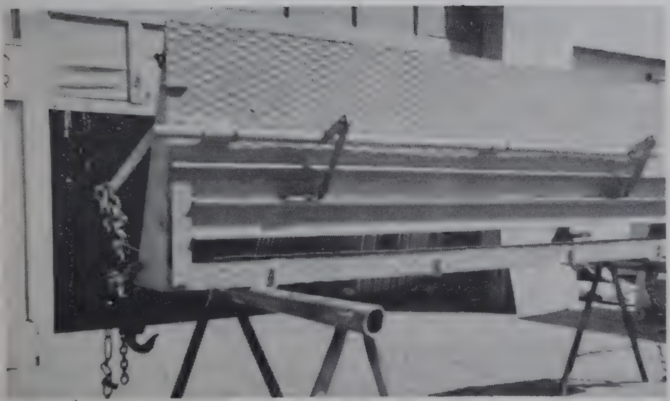
An article on this same subject appeared in Bulletin 9 in November. Since that time, District 5 has made some improvements which should be of interest.



Gravel shovel trough, District 5, Lamb County, 1951.



Forty-inch gravel spreader built in the bottom of a gravel shovel box used for covering narrow strips, District 5.



Eight-foot gravel spreader built in the bottom of a gravel shovel trough, District 5.

New Construction . . . .

F. M. 517 Overpass (Intersection U. S. 75 and F. M. 517) near Dickinson, Galveston County, District 12.

Contract let: December 12, 1950
Completed: June 9, 1952
Construction details: Two 180-foot continuous I-beam units on concrete bents, channel railing, 28-foot clear roadway.
Designed for: H-20 S16 loading cost including engineering, $82,500, Joe J. Estill, Senior Resident Engineer
District Engineer: Jim Douglas
Contractor: Austin Road Company, Dallas, Texas

Experimental Deer Guard

C. G. Wood, Senior Maintenance Foreman
DISTRICT 15

On F.M. 479 in Kerr County, complaints were frequent that goats crossed the cattle guards and strayed away. After mucn experimenting, a solution was found in an article in a magazine that deals with livestock and ranching problems. Attention was directed to the article by a brief narrative of its contents by a landowner. Consequently, yellow traffic paint was used to paint the entire mat of cattle guard. Then, on each side of the cattle guard about four feet away, a yellow band sixteen inches wide was painted across the pavement.

Only after the paint has become dull will a goat cross the cattle guard. One landowner related that a flock of goats coming down the fence line detoured the area where the yellow paint had been used. Property owners on F. M. 479 are highly pleased with the results. No more complaints have come in except once after rainy weather had made the paint dull. After repainting, results have again been satisfactory.

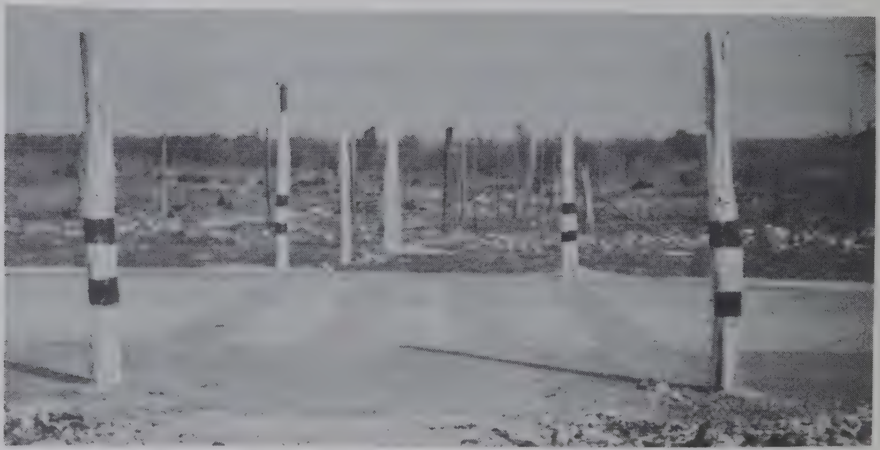
From the experience already related evolved the installation of a guard to prevent deer from drifting along the right of way on State Highway 39 into that part that is fenced on both sides with deer-proof fences.

Deer encountered on the right of way where ordinary low stock fences are existent can and usually do escape by leaping over the fence. But where they have drifted into that part of the right of way that is bordered by deer-proof fences, they often are turned back by the fence and they run into the path of approaching cars. They sometimes drift miles down these high-fenced roads and cannot find their way out.

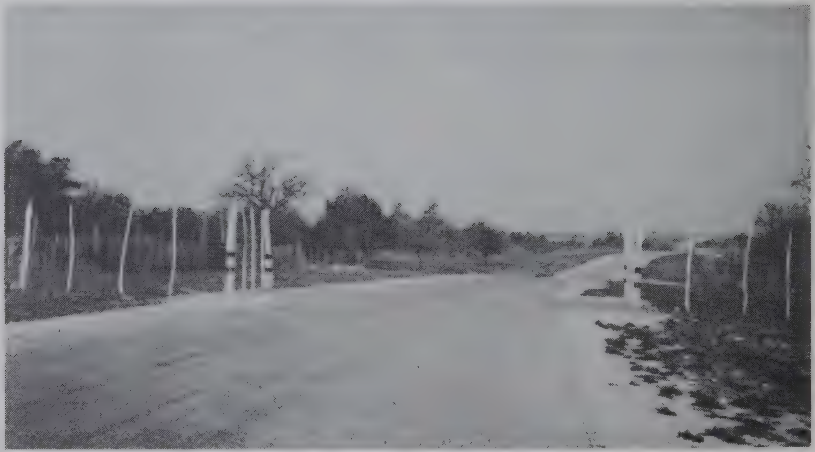
Two experimental guards have been constructed. At the point where the high and low right of way fences intersect, a projection of lateral high fence was attached. This lateral fence continues across the right of way to a point six feet from the pavement where it turns and a wing twelve feet long was built parallel to the pavement, forming an "ell." These ells, one on each side of the road, serve as drift fences and stop most of the deer.

The pavement was widened so that it extended from ell to ell. Then four yellow stripes 20 inches wide with 24-inch spaces were painted across the entire width of the extended pavement. Gates were built into the drift fences for passage of tractors and livestock. Deer drifting down the right of way are stopped on the side where they can jump the low right of way fence and escape into the pastures. Landowners are enthusiastic about the experiment and they believe it is 98 per cent effective. Not only are many deer saved but the hazard to traffic is relieved.

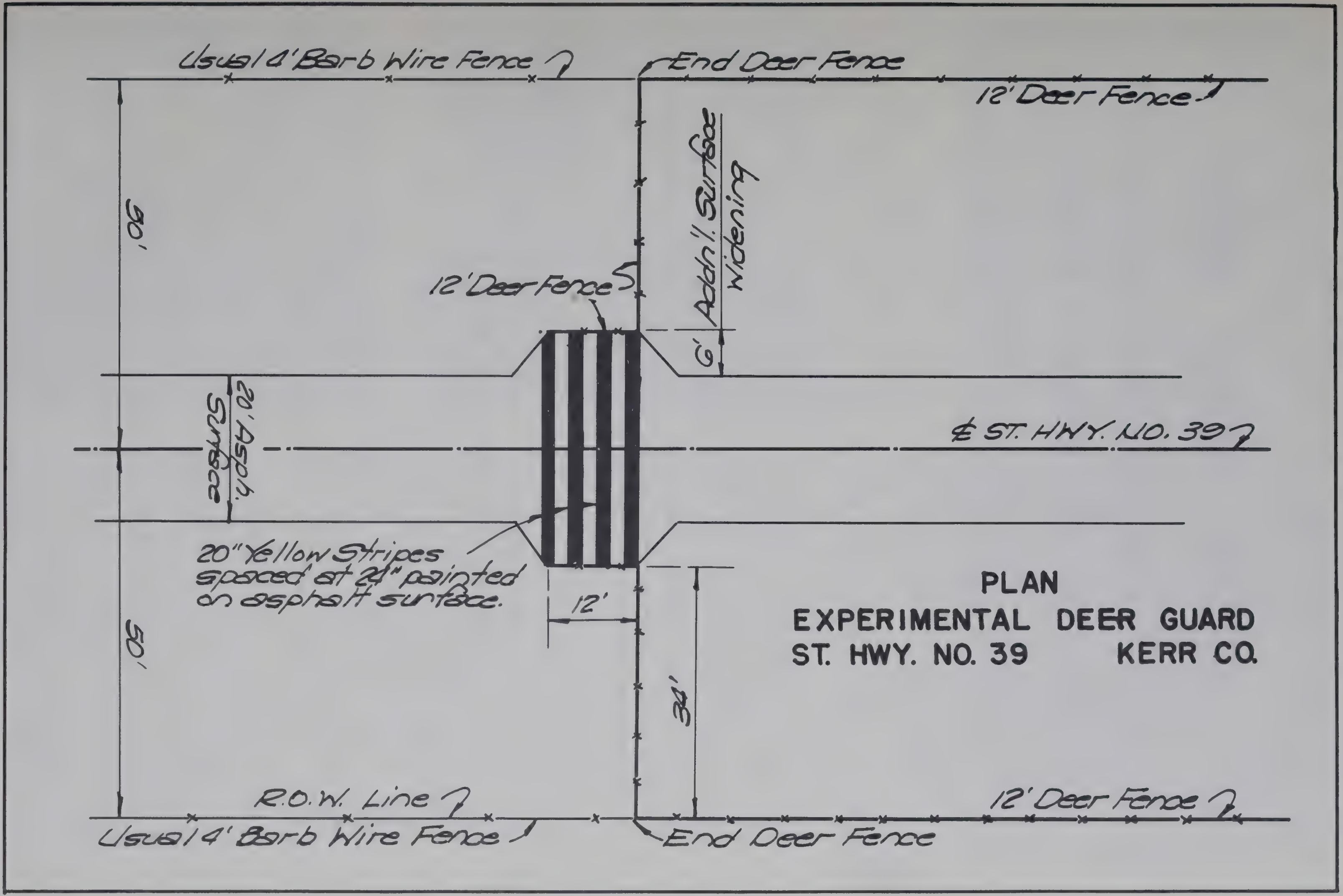
An example of the effectiveness of the yellow stripes on the pavement was manifest when a ranchman rode a horse across the guard. It took spurs and quirt and horsemanship to put the horse across. One spoiled doe that often went into the chicken yard at a house to eat feed is known to have crossed the guard. And one buck, during running season, crossed and was seen inside the high-fenced right of way opposite a doe that was in the adjacent pasture.



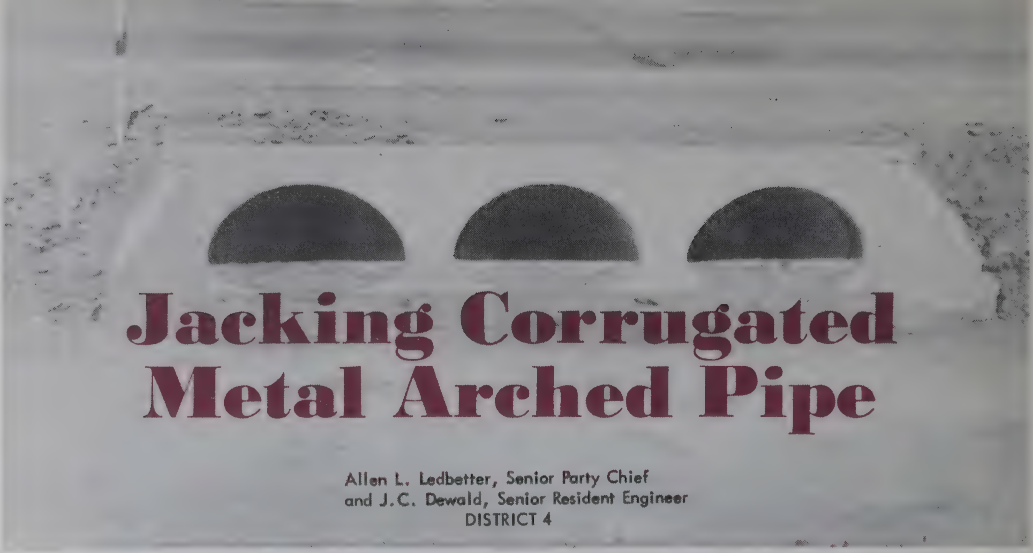
This unusual Deer Guard on S. H. 39 in District 15 is effectively keeping deer from drifting into sections bounded by deer-proof fences. Property owners report that it is 98 per cent effective.



Deer are afraid to cross the yellow stripes which are twenty inches wide, spaced 24 inches apart, and extend to the high fence wings on the shoulders. The State widened the pavement and placed the stripes, and the property owner erected the fence.



PLAN
EXPERIMENTAL DEER GUARD
ST. HWY. NO. 39 KERR CO.



Jacking Corrugated Metal Arched Pipe

Allen L. Ledbetter, Senior Party Chief
and J.C. Dewald, Senior Resident Engineer
DISTRICT 4

It had been evident for some time that the drainage structures on U. S. Highways 60 and 87 between Amarillo and Canyon were inadequate, but the problem of handling the traffic safely prolonged the installation of additional drainage facilities. This is a 36-foot wide, three-lane pavement, having a traffic count of between 8, 000 and 9, 000 in 1951, with probably more at the present time. This highway has a comparatively low grade, and lies on flat, slow-draining terrain. During heavy rainfall water crossed the road in several places and inundated residences and business establishments.

The normal method of installing additional drainage facilities on an existing pavement would be to excavate an open trench, place the structure and backfill, and rebuild the pavement above it. This was considered, but the traffic offered too great a hazard, both to construction crews and to the traveling public.

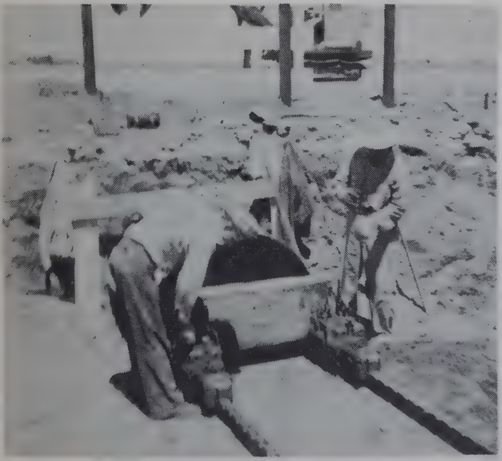
It was finally decided that corrugated metal pipe could be jacked under the existing pavement without the problem of traffic. A contract was let to jack nineteen strings of ten gauge, Design #6 Corrugated Metal Pipe Arch ranging from 58 feet to 104 feet in length. The pipe to be jacked was supplied in twelve foot sections, with smaller sections used to connect at each end.

Beginning about five feet from the edge of the pavement, to prevent interferance with traffic, open trenches were excavated approximately to flow line grade. Cross ties and rails were then placed so that the pipe would be on line and grade when placed on the rails. These two rails were ordinary 90-pound rails with notches cut every four inches on which the two 75-ton hydraulic jacks operated.

A twelve-foot section of pipe was set on the rails and centered. With the aid of the jacks, the pipe was pushed up to the embankment. A laborer then went inside the pipe with a clay spade and short-handled digging tools and began digging a tunnel the shape of the arch pipe ahead of the pipe. The dirt was hauled out in a small four-wheeled cart. After about two feet had been excavated ahead of the pipe, the pipe was then jacked through these two feet and the line and grade checked before continuing the digging operation. This process continued until about ten feet of the twelve-foot section had been jacked. Another twelve-foot section was brought into position and field connected with galvanized bolts to the end of the section in place. This operation was continued until the required length of pipe was in place. The line and grade were checked at regular intervals during the jacking operation.

Since most of the pipes were installed with a minimum of cover, the alignment and grade were important, particularly the grade. The grade was checked after each jacking operation with an engineer's level placed on a large timber resting across the rails. A two-foot section of a level rod was used to check the grade. When the pipe was found to be off as much as .05 of a foot, wedges were used to force the pipe up or down to the established grade. On most structures the alignment was controlled with a string line, although a transit, using an improvised tripod, was used on multiple and skewed structures. On multiple pipe structures the normal clearance between pipes was maintained. The clearance between an existing concrete structure and a pipe installation was 1.5 feet.

The two jacks in operation.

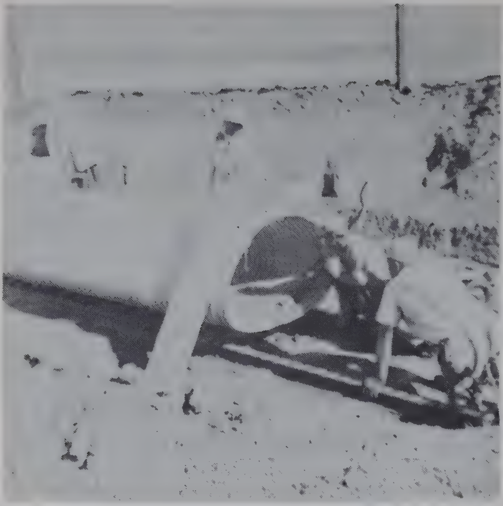


Setting the two jacks in position for jacking operation.

Note the transit used to maintain proper line on pipe during jacking operations.

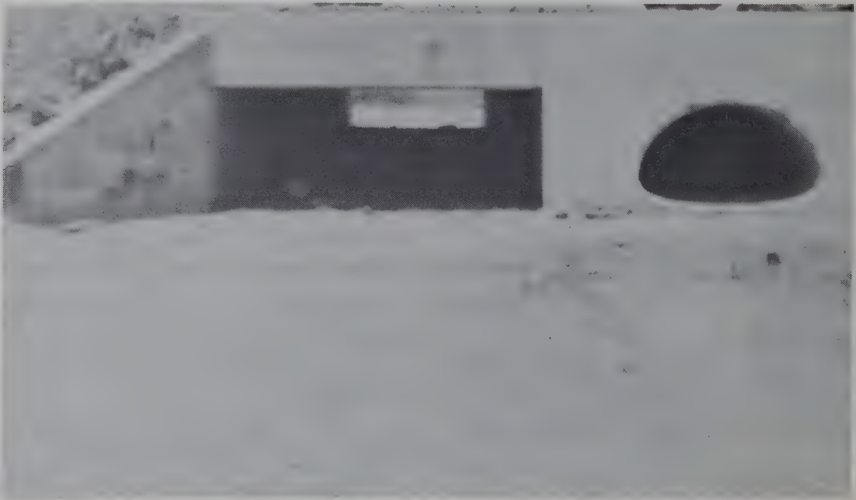
On this project the contractor guaranteed that there would be no settlement above the structure. It was evident from the beginning that some voids existed between the pipe and the surrounding soil. Two factors accounted for these voids. First, the workmen could not excavate the opening exactly the shape of the pipe, and second, the shrinkage was high in the tight, moist soil. Upon completion of jacking operations of each structure, grout consisting of a mixture of brick clay, blow sand, and water, was immediately pumped into the voids. This grout was pumped through two-inch nipples welded twelve feet apart in the top of the pipe. After the pumping operation was completed, a plug was screwed into the nipple.

Compared to other methods of installation, jacking pipe is considerably slower; however, we wish to emphasize not the speed, cost, or method of installation, but the safety features involved. During 59 days of construction not one accident occurred on this project as a result of the work in progress. Most of the motorists passed by unmindful of what was going on. So we believe that if one life was saved, or one serious accident prevented, the extra time involved was well spent.

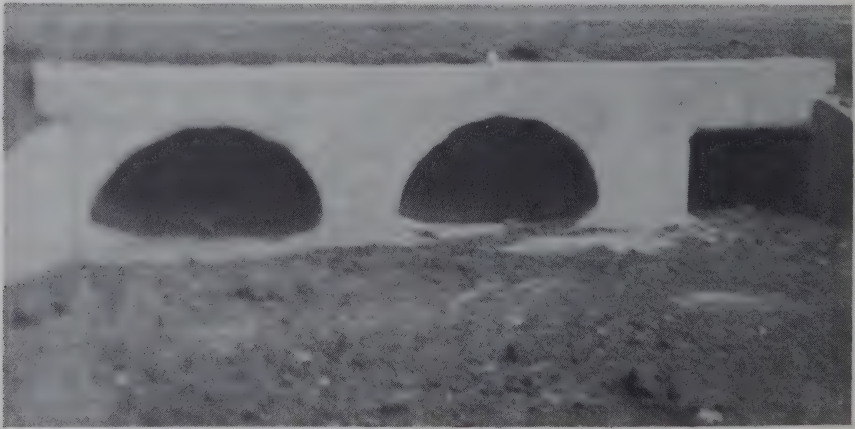


Workmen waiting to resume work after the grade had been checked and another section field connection to a section in place.

Pumping a mixture of brick clay, blow sand, and water into a completed pipe.



Completed Design 6 corrugated metal pipe arch with headwall joined onto an existing concrete culvert.



Two Design 6 corrugated galvanized metal pipe arches added to an existing 3' x 2' fifteen degree skew concrete box culvert.

Processing Caliche-Gravel With Grid Roller

S.R. Busby, Assistant District Engineer
DISTRICT 21

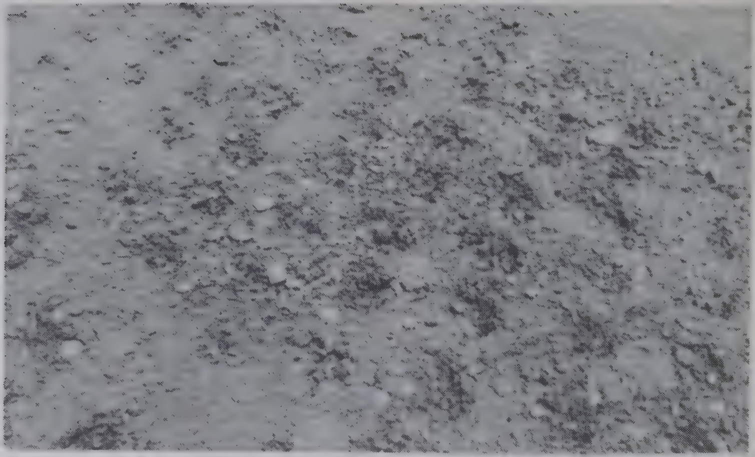
In District 21 along the Rio Grande between Laredo and ten miles west of Mission there are numerous deposits of excellent caliche - gravel base material. This material, in general, consists of cemented gravel and conglomerate containing a caliche or volcanic ash binder and in some sources overlaid with hard sandstone and calcareous sandstone rock. The gravel is siliceous material with a per cent of wear of about 18 (Los Angeles Abrasion Test) and the deposits contain some oversize gravel up to about six inches in diameter.

This gravel conglomerate, even without the caliche and sandstone rock, is a difficult material to process and lay on the road. Attempts have been made to use pit-run material and break it on the road with sheepsfoot rollers but unsatisfactory riding surfaces have resulted as the sheepsfoot roller would not break the gravel or hard rock. The oversize gravel and rock would be pulled out in blading the surface, leaving depressions in the base. For this reason processing this material in a crushing and screening plant has usually been required for at least the top course of the base but this is expensive, especially due to the excessive wear on the crusher caused by this siliceous gravel.

On Project F 337 (2) in Starr County, now under construction, the top four inches of the base was specified to be of processed material. However the contractor brought in a grid roller of the same type described in Construction and Maintenance Bulletin Number 7 and requested that he be allowed to lay a test section of the top course using pit-run material. This test section was laid and it was found that by using the grid roller a satisfactory riding surface could be obtained using pit-run material. A field change was then submitted and approved to substitute "Flexible Base (Pit Run)" for "Flexible Base (Processed)" for this top course at a saving of 12 cents per cubic yard.

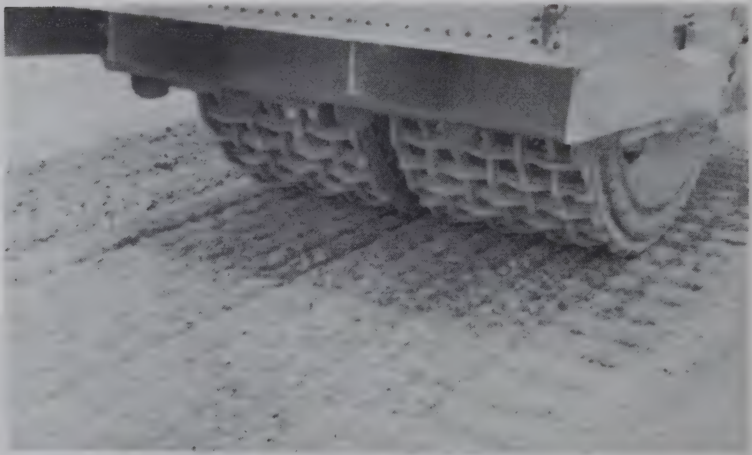
Before this test section was laid, both the sheepsfoot roller and the grid roller were used on different sections of the first course to compare their efficiency in breaking up and compacting the material. The material was broken up by spreading the material out on the subgrade in thin layers and rolling each layer. After the material was broken down to the smallest practical size, the material was windrowed, sprinkled, mixed, spread, and compacted.

The specifications for processed material required that the material be crushed to pass a two and one-half inch screen. It was found that the grid roller in six passes would break all of the material except siliceous gravel to meet this requirement and even broke some of the siliceous gravel. However, no practical amount of rolling with the sheepsfoot roller would crush the harder caliche or sandstone rock to this size. This is because the feet of



Surface of base after compaction with sheepsfoot roller. Note the torn surface which results in large gravel being brought to surface.

Close-up of flexible base source showing hard rock and gravel conglomerate.



Close-up of grid roller showing surface of base after compaction. Note the uniform gridded surface free from torn areas.

the sheepsfoot roller slip off of, or dislodge large rock so that rock cannot all be broken to a much smaller size then the spacing of the feet. On the other hand, the raised portions of the grids crush the rock without dislodging it or slipping off.

Comparison of the effectiveness of both rollers in compaction was made by measuring the density of the compacted base in adjacent lands, one compacted with sheepsfoot roller and one by the grid roller. The same amount of rolling time per station was used in each case. In both, the loose surface of the course left after rolling with the grid roller or the sheepsfoot roller, was compacted by pneumatic rolling. Four test lands were compacted. Lands 1 and 2 were constructed with material from a source containing both gravel conglomerate and hard rock. Lands 3 and 4 were constructed with material from a source containing gravel conglomerate without caliche or sandstone rock. A minimum of four density tests was made in each land with the following results:

Lands	Kind of Roller	Density Tests	Lbs. Per Cu. Ft. (Average)
1	Grid	120, 127, 126, 116	122
2	Sheepsfoot	126, 120, 119, 118	120
3	Grid	134, 127, 134, 123	130
4	Sheepsfoot	133, 131, 129, 132, 131	131

These tests show that practically equal densities were obtained with the two rollers. The material used in Lands 1 and 2 has a lower specific gravity than that in Lands 3 and 4 because the material in Lands 1 and 2 contains a large amount of lighter caliche and sandstone rock.

It was found that the grid roller pushed most of the oversize gravel down into the course leaving only a small amount to be thrown out by hand. This was not the case with the sheepsfoot roller. It tended to dislodge and lift up the larger gravel, leaving a loose layer on the surface.

The use of a grid roller on this project has resulted in securing a much better riding surface than has ever been secured with sheepsfoot rollers on pit-run material. The cost of the work has been materially reduced by using pit-run material in place of plant-processed material. Also, as work progressed on this project, the amount of rolling required for breaking up and compacting the base could be reduced to about two-thirds that required with the sheepsfoot roller. This resulted in still further saving in cost.

Grid roller unit.

Sheepsfoot roller unit.

Kickoff Blade
For American 8 Maintainer

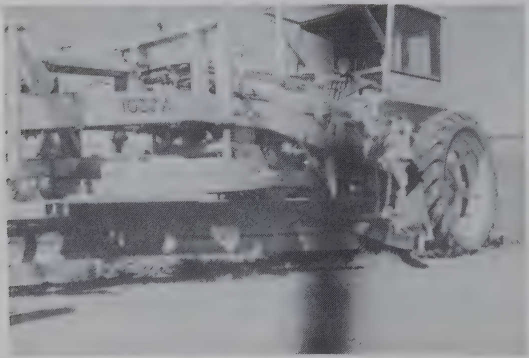
O.B. Seabourn, Equipment Supervisor
DISTRICT 8

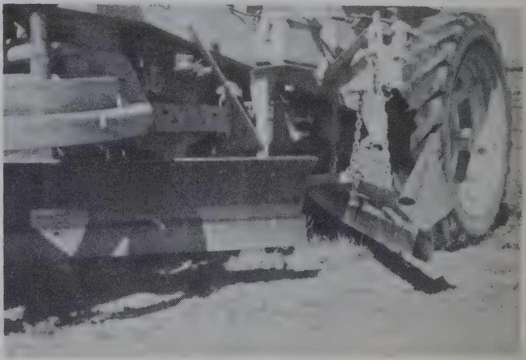
We have built what we call a "kickoff blade" which is attached under the rear axle of our American 8 Maintainer. We find that it does work as well as our patrol blades for shoulder blading and is a much cheaper operation.

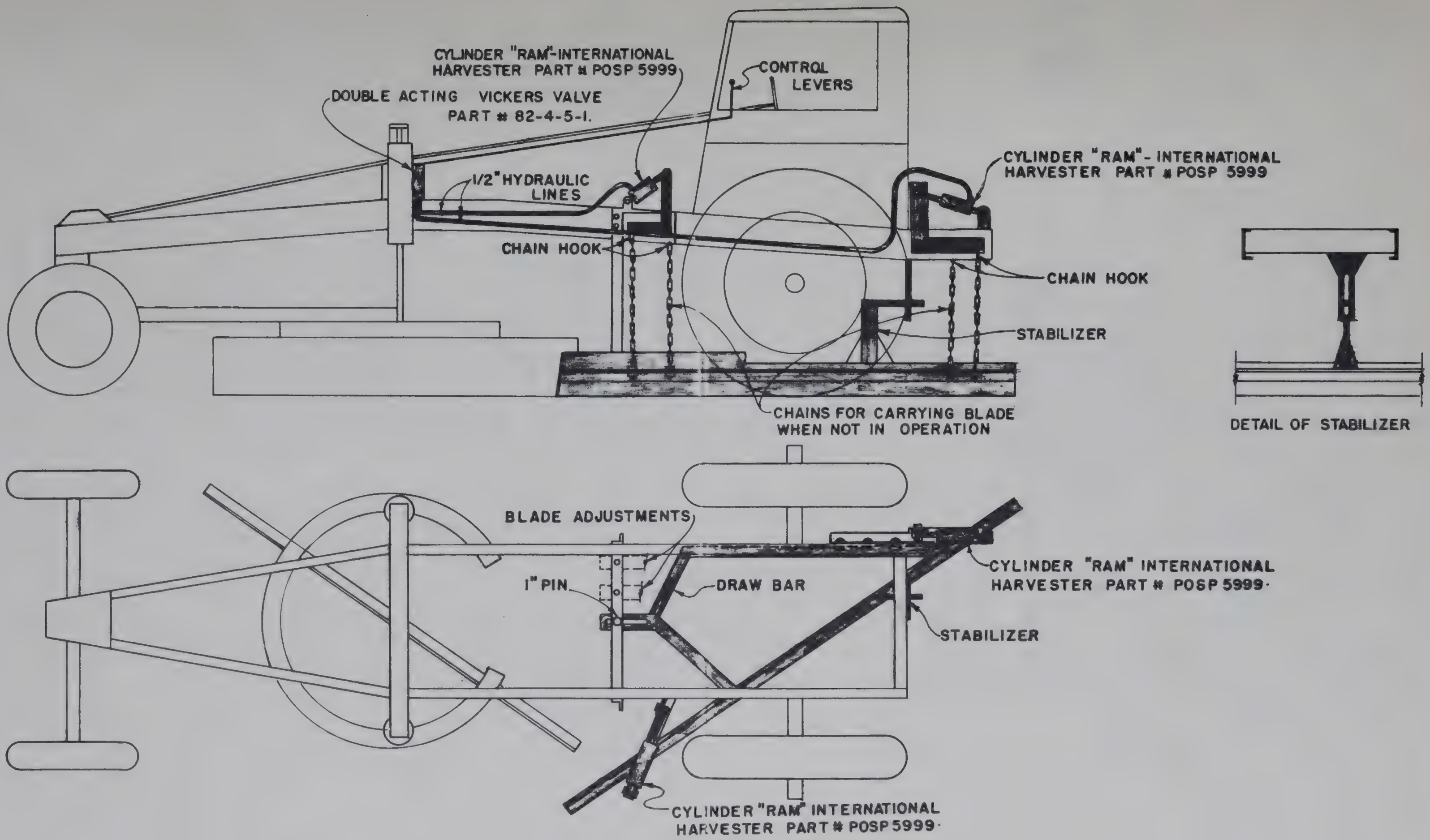
The operator can operate both blades, using the blade on the maintainer to cut to the pavement and the kickoff blade to cut back with. We added two control valves to our present control box and used two hydraulic cylinders commonly used on Farmall equipment for raising and lowering farm equipment. We built the draw bar adjustable, to change the angle of the blade, and slotted it so that when the blade is raised it will move forward eight inches to clear the rear tire on the maintainer.

The moldboard is twelve feet long and is made from seven-inch channel iron and has two resharpened blades bolted to the channel. The draw bar is made of three-inch by three-inch angle iron. The hitch that pulls the draw bar is bolted to the frame of the maintainer and extends under the transmission of the machine. When roading the machine, the draw bar can be moved to the right side of the blade adjustment and will move the blade under the machine so it will not bother traffic. We first built one mounted on the rear of the machine, but found that it was too hard to turn around in a narrow right of way or where the ditches were deep. By mounting it under the rear axle, we can use the rear tire at the edge of the pavement for compaction when blading damp shoulders.

The valves cost $25.30 each, the cylinders cost $11.65 each and the hydraulic lines will cost about $20. Counting all labor and materials these kickoff blades cost us about $200 each.






CYLINDER "RAM"-INTERNATIONAL HARVESTER PART # POSP 5999
CONTROL LEVERS
DOUBLE ACTING VICKERS VALVE PART # 82-4-5-1.
CYLINDER "RAM"- INTERNATIONAL HARVESTER PART # POSP 5999
1/2" HYDRAULIC LINES
CHAIN HOOK
CHAIN HOOK
STABILIZER
CHAINS FOR CARRYING BLADE WHEN NOT IN OPERATION
DETAIL OF STABILIZER
BLADE ADJUSTMENTS
1" PIN
DRAW BAR
CYLINDER "RAM" INTERNATIONAL HARVESTER PART # POSP 5999·
STABILIZER
CYLINDER "RAM" INTERNATIONAL HARVESTER PART # POSP 5999·

KICK OFF BLADE
FOR AMERICAN 8M MAINTAINER
DISTRICT 8

THE HIGHWAYS

The greatest single factor contributing to the social and economic welfare of any community, state, or country is the road. The roots of the road are planted deeper than civilization itself. The history of the road winds its way back through the yesteryears to its origin -- which was the beginning of mankind.

In the beginning, prehistoric man used animal-made trails. Later he began to improvise his own paths which connected these trails and in many instances, provided a way which could be traveled more comfortably. Animals naturally made paths and trails near the waters and lowlands for the purpose of feeding and protection. Man soon discovered that both time and distance could be saved by providing ways which would connect these animal-made trails. He later found that in many instances it would be better to detour from these swamp trails and provide a way on high or dry ground. Thus these first man-made "ways" on high ground were referred to and logically called "highways." Thus, the term highway was coined and has been used throughout the ages.

Still later, with the discovery of the wheel, the road literally became interwoven with the social, military, and economic progress of civilization. History indicates that the road has invariably influenced the rise and fall of peoples, empires, and countries alike. Yet many people take the road for granted. They are like the "wanderer who couldn't see the forest for the trees." The road is silent, the humblest and the most subtle. It is responsible for man's basic necessities of life -- food, clothes, and shelter. Of all the primal influences and things, the road is the least obvious and the most important.

There can be no doubt but that the highway has, and will always be, a key factor to man's cultural, spiritual, and economic development .

Special Report On Mudjacking

Charles W. Ruckman, Highway Engineer
BUREAU OF PUBLIC ROADS
Working with
Zay Johnson, District Maintenance Engineer
DISTRICT 13

BACKGROUND

Mudjacking of concrete pavements for some time, especially since the war, has been looked on with disfavor in most of Texas. Past experiences with this method of leveling rigid pavements have been generally unpleasant with a majority of District Engineers and seem to have paid small dividends, except in one district.

The Highway Department purchased its first mudjacking machine in 1932 and at present owns nineteen. Seven of these are now concentrated in District 13, where they are being used regularly. The remaining twelve are dispersed over the state singly or in pairs to various districts where they are used infrequently.

District 13 has 470 miles of concrete pavement, all placed between 1930 and 1942. Subgrade soil conditions vary from a black waxy clay in the southern counties and the coastal area to a sandy loam which prevails over the north and central counties. The topography is very flat on the coastal region and slightly rolling to the north.

EROSION BY SLAB PUMPING

The major factor that causes concrete slab failures, here as elsewhere, is pumping. Pumping results from a combination of free water, unsuitable subgrade soil, heavy axle loads, and joints and cracks in the pavements. Pumping ultimately creates void spaces where more and more water accumulates and repeated deflections of the slab enlarge the unsupported areas until the pavement is finally stressed to the breaking point.

CORRECTIVE MEASURES

A rigid pavement surface cracked and deflected so extensively that its riding qualities are unsatisfactory can be repaired by placing a leveling course on top of the slab, or it can be repaired by placing the leveling material under the slab, as in mudjacking.

If the mudjacking is performed before breakage occurs it is thought of as preventive treatment. If delayed until after breakage it is called corrective treatment. Preventive maintenance is obviously much less costly and more satisfactory than corrective maintenance. But, with the recent large increase in trucks, both in number and in size, and carrying maximum axle loads along with increased speeds, the period when preventive maintenance can be done is of short duration. The time that elapses between the first noticeable incipient pumping action and the first slab crack is only a few weeks at most.

In addition to failures resulting from pumping there are certain areas in the north counties of this district where the soils are stratified and the types change abruptly. Irregular swell and shrinkage occur in these areas and the slabs deform and break up before pumping starts. Quite often the first evidence of distress in the pavement is the crack or breaks that come indicating an unsupported slab. Pumping in these situations is also done as a corrective measure. A certain amount of preventive treatment always results from the spread of the slurry into shallow cavities where progressive breakage has not reached.

METHOD IN GENERAL

The machine for pumping consists basically of a gasoline engine powered mixer and a force pump. The mixer has paddle blades attached to a shaft and set at an angle to force the material being mixed toward the pump as the shaft and blades rotate. The pump, or pistons, pick up the mixture and force it through a hose to the nozzle that is placed through jack holes previously drilled through the slab.

The first mixtures were very appropriately called mud, as they consisted only of water and the soil that happened to be alongside the slab. Later, various ingredients were added to the mud mix in an effort to improve its stability. Portland cement, lime, limestone dust, sand, and liquid asphalts are the more common admixes tried - all with certain amounts of success. Now, the soil that is to be used in mudjacking is closely controlled as to gradation and physical properties. It is often hauled a considerable distance from pits and is stockpiled at convenient places along the right of way of the section of road to be jacked.

METHODS COMPARED

Since one maintenance engineer can use mudjacking successfully, a detailed description of his methods and procedure might be of interest to others. In the following description I will try to set out the differences in District 13 methods and those commonly used over the country and considered standard procedure:

1. It is common practice to drill the jack holes through the slab two and one-half to two and five-eighths inches in diameter. The manual of instructions supplied with mudjacking machines recommends a hole this size. The District 13 method is to drill a one and one-half-inch hole and thus greatly reduce the spalling that occurs at the undersurface of the slab. The smaller hole does not weaken the slab as the larger hole does. Further, the smaller holes can be drilled much faster than the larger holes.

2. It is usually common practice to space holes in the slab arbitrarily on the theory that the slurry will spread uniformly in all directions. The District 13 method is to spot the holes according to distortion in the slab and the lift or tilt desired, as analyzed by the foreman. The foreman marks the location with paint or crayon on the slab where each hole is to be drilled. For uniform lifting of settled slabs, holes are drilled in two rows in each lane at six-foot spacings, one row eighteen inches from the center line and the outside row two feet from the pavement edge. The holes in the row adjacent to the center line are pumped first.

3. Holes are commonly drilled by one jackhammer operator. The air compressor is usually truck-mounted and a driver for the truck is required. The District 13 method is to mount two jackhammers on a farm tractor that tows the compressor. The jackhammers are moved up and down by hydraulic controls. One man, the tractor driver, operates and controls everything.

4. It is common practice to use a slurry with from three to four sacks of cement per cubic yard of soil. A rigid support having the characteristics of the pavement is thought desirable. The District 13 method is to use much less cement, approximately one sack to the cubic yard of soil and 60 gallons of RC-2 asphalt. Their theory is that the support material should have the load carrying characteristics of the sub-

grade, should underseal, and also be entirely waterproof without brittleness. They also believe there should be a period of at least 30 minutes when fresh pumped mud will move, or flow, under loads from traffic. It has been found that traffic impacts are harmful to a rich cement slurry during the time between initial set and final set. The small amount of cement used by the District 13 operators is added, not because of its hydraulic properties or any set it can give the mixture, but because of the great increase in surface area it affords the liquids in the mix, thus keeping it homogeneous when under pressure. It keeps the water and asphalt from flowing away from the soil particles in the pistons and the hose. The mixer is fed in increments of one and one-fourth cubic feet of soil, three gallons of RC-2 asphalt, three to four pounds of cement, and water to bring the charge to the desired consistency.

5. Holes are usually jacked one time only and are plugged permanently. In District 13 the holes are jacked as many as three times for one lift and at a later date may be jacked again to remove any settlement that has occurred after the first jacking. Rotation of injections into the holes is done to keep from cracking the slab and the proper sequence of injections to obtain best results is learned only by experience.

The holes are not plugged permanently but are corked with a round piece of hardwood about one-half inch thick and one and one-half inches in diameter. They are plugged temporarily to stop spillage when a slab is being lifted by rotating the injections. After the last injection the holes are stoppered with the hardwood cork.

6. Both lanes are usually jacked together and there is no difference of opinion here. This is desirable though not at all practical when traffic is moderately heavy. In District 13 on the heavier traveled roads one lane is sometimes worked all day and the adjacent lane then worked the next day.

7. The usual procedure in selecting soils for mudjacking is to make a visual inspection only to check against coarse particles and an excess of clay. District 13 makes a screen analysis and checks the plasticity index periodically of all mudjack soil sources. The soil used has a PI of from 1 to 4, a maximum shrinkage of 1 per cent, 100 per cent passes the 20 mesh screen and 90 per cent passes the 40 mesh screen.

8. Usual practice is to lift the slabs and estimate by eye whether or not they are at the proper position. In District 13 the slab is lifted to a string line. The string line is placed first near the center line as the center row of holes is jacked first and then placed near the edge as the outer holes are jacked. The amount of rise is thus gauged accurately. The only occasion when a string line is not used is when pumping to fill voids only. The string line used is more often a piano steel wire than it is an actual string. It is held taut and moved about by the two flagmen.

CHANGES MADE IN THE STANDARD MUDJACK MACHINE

1. Pipe the machine for receiving asphalt from the tank heater and place a quick-acting valve and a three-gallon open top reservoir for the liquid asphalt near the mixing basin.

2. Place two one-and-one-fourth cubic foot capacity hoppers for measuring soil side by side over the mixing basin.

3. Install a perforated pipe over the top of the mixer shaft and paddles to assure an even distribution of water in the mix and reduce mixing time.

4. At the pump outlet place a three-inch pipe cross fitting and install a coarse screen made of truck engine valve stems with spacings about three-fourths inch in one of the four channels of this fitting. The screen must be placed at the outlet end of the cross and the flow must turn at right angles

to direction of flow from the pump to pass through this screen into the hose. This arrangement allows the rocks, stones, and pebbles to go directly across the pipe fitting where they will lodge in an end of the cross that is plugged and not stop on the screen. The two channels of the cross that are plugged facilitate cleaning. The screen must withstand an extreme amount of pressure and the truck engine valve stems, being a high strength steel, have been found more suitable for the purpose than any other type of steel rod tried.

5. Remove the two-inch discharge nozzle and substitute a one-inch size nozzle that will fit in the one-and-one-half inch drilled holes. Improvise a steel "no-splash" shield to fit around the nozzle, and a steel disc approximately the diameter of the shield to fasten above the discharge nozzle for protection of the nozzleman and the rest of the crew.

Whether or not to install a quick acting valve at the nozzle is left to the discretion of the foreman and the nozzleman doing the work. As the nozzlemen become more skilled, there is a tendency not to use the cutoff valve. Whether the cutoff is used or not the mixer operator always stops the pump between holes. It is all-important that the pump be stopped when the nozzle valve is closed. The machine has the capacity to handle two hose but the work is never so satisfactory as when one hose is being used. The nozzlemen have difficulty staying coordinated when two are pumping the same slab. It is often done though, and is more satisfactory when the lift is high and a large volume of mud is required. A total volume of 40 cubic yards has been pumped in a nine-hour day when using two hose.

THE CREW

A complete crew and duties of each member are listed as follows:

One foreman.

One jackhammer man.

Two stringmen who each have flags and tend barricades or warning signs.

One mixer operator who controls quantities of materials that go into the mixer and operates the pump. He also tends the asphalt tank and heater.

Two truck drivers who haul soil and shovel it into the mixer batch measuring hoppers. They also place the small amount of cement in the hopper, each filling from an open sack that is placed on a shelf back of the truck cab.

One hose tender.

One plug man who shovels excess slurry off the pavement and corks the holes after filling.

One nozzleman.

An overhead loader is placed at the soil stock pile and each truck driver loads his own truck. It is possible to use only one truck driver without impairing operations. Two trucks are loaded in the morning and two at noon. This gives sixteen cubic yards of earth which is sufficient for an average day's run. One of the other crew members drives the second truck to and from the section warehouse. The foreman drives the water truck.

COSTS

Mudjacking costs vary from $12 to $20 a cubic yard in place, depending on the amount of void space beneath the pavement. The greater the amount of voids, the less the unit cost.

For leveling a concrete pavement on the top side with a hot mix or a premixed asphaltic concrete, costs range from $9 to $15 a cubic yard in place. The end result is not as good though, nor is the repair as durable as when made by mudjacking with the thin asphalt soil slurry. There are sections of concrete pavement in Gonzales and Fayette Counties on heavily traveled U.S. 90, Interstate, completely rehabilitated five years ago by mudjacking on which there has been no subsequent settlement or pumping and maintenance costs have remained nominal.

MUDJACKING "DO'S AND DON'TS" PECULIAR TO DISTRICT 13

1. Keep the slurry mix thin, always. A thick slurry results in stools and these are "poison." Gauge the consistency of the mix by the sloshing sound of the mixer paddles.

2. Drill jack holes through the pavement with the smallest jackbit possible. Use one-and-one-fourth or one-and-one-half-inch diameter bits, and drill holes at the right places.

3. Rotate injections into the holes. Go back over the holes two or three times on each slab to keep it from breaking.

4. Have an experienced crew.

5. Heat the RC-2 asphalt to 175°F in the morning and again at lunch time. The asphalt mixes and flows best when above 140°F. When warm it makes for easy mixing, lubricates pistons and valves, alleviates any harshness due to an excess of sand, and flows uniformly. Mix continuously, do not run individual batches through the machine.

6. Check for firmness of the mix the day after pumping by digging down at the pavement edge and uncovering some of the previous day's run.

7. Jack from area of least lift toward areas of highest lift by rotation, but jack lower areas greater amounts each lift. However, do not start at a joint. Usually the lowest point is at the joint. Always cross over the joint beyond the slab to be jacked and drill two jack holes in each lane approximately two feet from the joint and pump these holes last.

8. Don't be afraid to come back and jack a slab a second time. The second injection can be done hurriedly and will take up any settlement that occurs after the first jacking. Corks are easily removed with a screw driver and the holes cleaned out by means of a hand bar or are blown out by using the compressor.

9. Wet the top surface of the slab before pumping starts when doing city work. It requires an additional water truck but reduces sticking and discoloring of the pavement by the spilled slurry.

GENERAL

The mudjack treatment is the only established method for restoring the stability of the subgrade beneath concrete pavements. However, in the past some concrete pavements have been built on subgrade materials of such poor quality that no type of treatment within reason will improve the stability. Mudjacking has its faults and shortcomings and improvements should be developed in machines and procedures. More accurate means of determining size and extent of void spaces beneath pavements are needed. A better crack-sealing compound is very much needed. At present, as an average, two and one-half hours each day are lost in preparations to start pumping, stoppages, and in cleaning out the machine at the end of the day's run. The ideal slurry mix is yet to be developed. It has been found that excellent work can be done with a properly-graded soil that has a PI of 3 and a shrinkage of 1 per cent using water only without an admix of any kind. District 13 has been experimenting along such a course with its better mudjacking soils. As a further experiment they plan to try air entraining agents in their slurry mixes to see if harsh or improperly-graded soils can be used.

MUDJACKING OPERATIONS

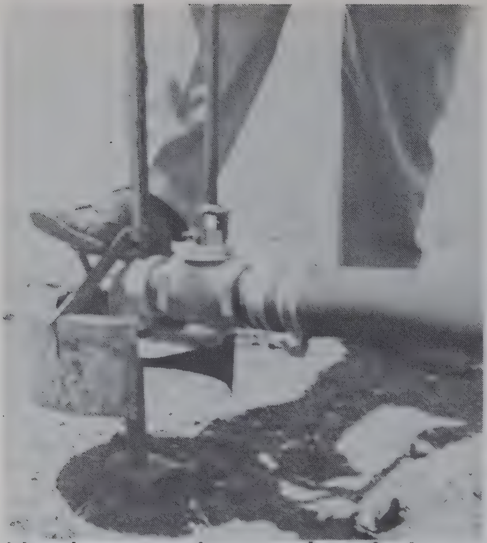
Arrangement of water truck, asphalt tank and heater, mudjacking machine, and soil truck ready to start pumping.

Tractor with mounted jackhammers towing a 210 c.f.m. compressor. One operator is required.

Foreman observes slab movement in relation to string line.

Filling hopper with soil and adding small amount of portland cement.

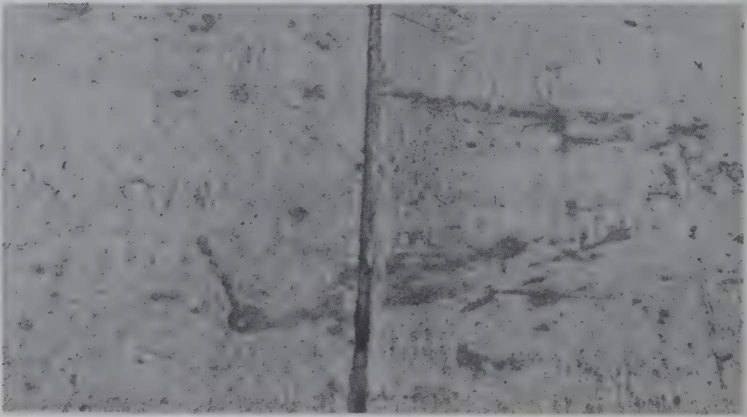
Holes temporarily plugged for rotating pumping. String line shadow at left shows lift not quite up.



Nozzleman stands on nozzle to feel pressure build up and watches stiffness of hose for excessive pressure. Note quick-acting valve and protection shield.

Traces on pavement show movement of nozzleman crossing over the joint beyond the low slab and pumping the end of the sound slab.

Pumping and stoppering holes with the 1/2 inch by 1 1/2 inch hardwood cork.



Hardwood corks remain in place and excess slurry is soon removed by traffic.

Treat Your New Heavy Equipment To A "Warm-Up"

John B. Nations, Director
Equipment and Procurement Division

That shiny and valuable new piece of equipment which has just been delivered to you deserves proper breaking-in. It will serve you better for having had a good start. So to be sure it will give you a lot of hours of honest work, give your new unit a fair chance to limber up. By following a few simple instructions, you can put its "muscles" in top-notch condition to dig in and move more budget-saving loads for you.

Generally, the equipment distributor will give the necessary break-in instructions when he delivers the unit. If possible, the future operator and shop foreman should be on hand to receive these instructions. The main points on how to extend the service life of your new equipment by treating it to a "warm-up" period are as follows:

The first item on the check list for a new unit is lubrication. Make sure that unit is completely serviced before it is put to work. Ordinarily, the unit will be delivered already serviced with break-in oil in crankcase, in which case it can be put to work right away. Be sure that you drain this original lubricant at the time indicated by the manufacturer on the shipping tag; then follow your operator's manual for instructions as to what type of oil should be used.

Incidentally, factory recommendations for lubricating oil are more important today than ever before. Engines deliver more horsepower today for the same cubic inch displacement than they used to some years ago. Naturally, a higher output engine demands better lubrication than an engine running under lighter loads.

Naturally, it's always good practice to take care to store lubricating oils properly to avoid any contamination of the lubricants before they are introduced to the tractor lubricating system.

When the unit actually gets on the job, it is important to be sure that the engine is completely warmed up. The engine should run at a fairly fast idle so it will warm up in a shorter time. A shorter warm-up period not only saves time but prevents condensation from forming in the crankcase, an action which hastens the contamination of lubricating oil.

The operator has an opportunity during the warm-up period to make a visual inspection for oil, water, and fuel leaks. He should also check the oil and radiator coolant to see that these fluids are at the proper levels. Sometimes a slight grease leak that may be caused by over-lubrication will be discovered in the chassis. Such leaks will usually disappear when the moving parts "seat" themselves after the break-in period.

Once the engine is warmed up, it's

an excellent practice to give the unit an "exercise" run. Mainly, this is a safety measure, and it provides a chance to test all controls for proper operation. It also gives the operator an opportunity to become familiar with the controls, which are somewhat different on each model or make.

If the unit is a tractor and has a bulldozer blade or other equipment mounted on it, the controls for these units should also be tested at this time. If the tractor is to work with a scraper, now is the time to hook it on and test the power control unit.

Your unit is ready to work by this time but don't give it "the works" just yet. It is better to operate the machine in a gear that will not pull the engine below rated speed. This gives the engine a chance to "run in" easily, whereas hard work from overloading a new engine causes excess heat to build up and eventually results in increased wear.

The period of moderate operation is generally prescribed by the manufacturer, and it usually is about 30 hours. Traveling speeds should be kept moderate to give parts and chassis assemblies a chance to "seat" themselves and take on a "wear hardening."

As this initial operating period passes you can gradually increase the traveling speeds and loads.

And remember -- PM starts immediately -- it is the little bit of work now that can save you a lot of work later.

* * *

THE STEEL SITUATION MUST BE SERIOUS . . .

These hollow logs were used as side road culverts.

Spring-controlled Flag Holder

By Alton Vordenbaum, Construction Superintendent
Suggested by Max Hanz, Skilled Laborer
DISTRICT 15

Keeping the warning flags on road equipment in good condition at all times has long been a problem in the Maintenance Department. It has been especially difficult to keep the flags on maintainers and mowing machines from being torn off by trees and brush.

Recently Max Hanz, Maintainer Operator in Comal County, decided that if a flag holder could be made that would bend readily when meeting an obstacle, such as a tree branch, and fly back to its original position afterward, much of this trouble could be prevented. He proposed to bring this about by means of a spring weak enough to bend under reasonable pressure but still strong enough to straighten up when the pressure had been removed.

Since using salvage materials seemed to be the most economical method of constructing such a holder, Mr. Hanz secured an old bicycle frame for the flag socket, and a valve coil spring from an old tractor motor. The bicycle frame and spring measured one inch outside dimension. A two-and-a-half-inch length of tubing was welded to the four inch valve spring. The head of a three-eighths inch by one-and-a-half-inch bolt was inserted one-half inch into the spring and securely welded in place. A three-sixteenths-inch hole was drilled one-fourth inch from the top of the holder, through which a key was inserted into the flag handle, preventing it from being pulled out. The flag holder was then bolted on the equipment.

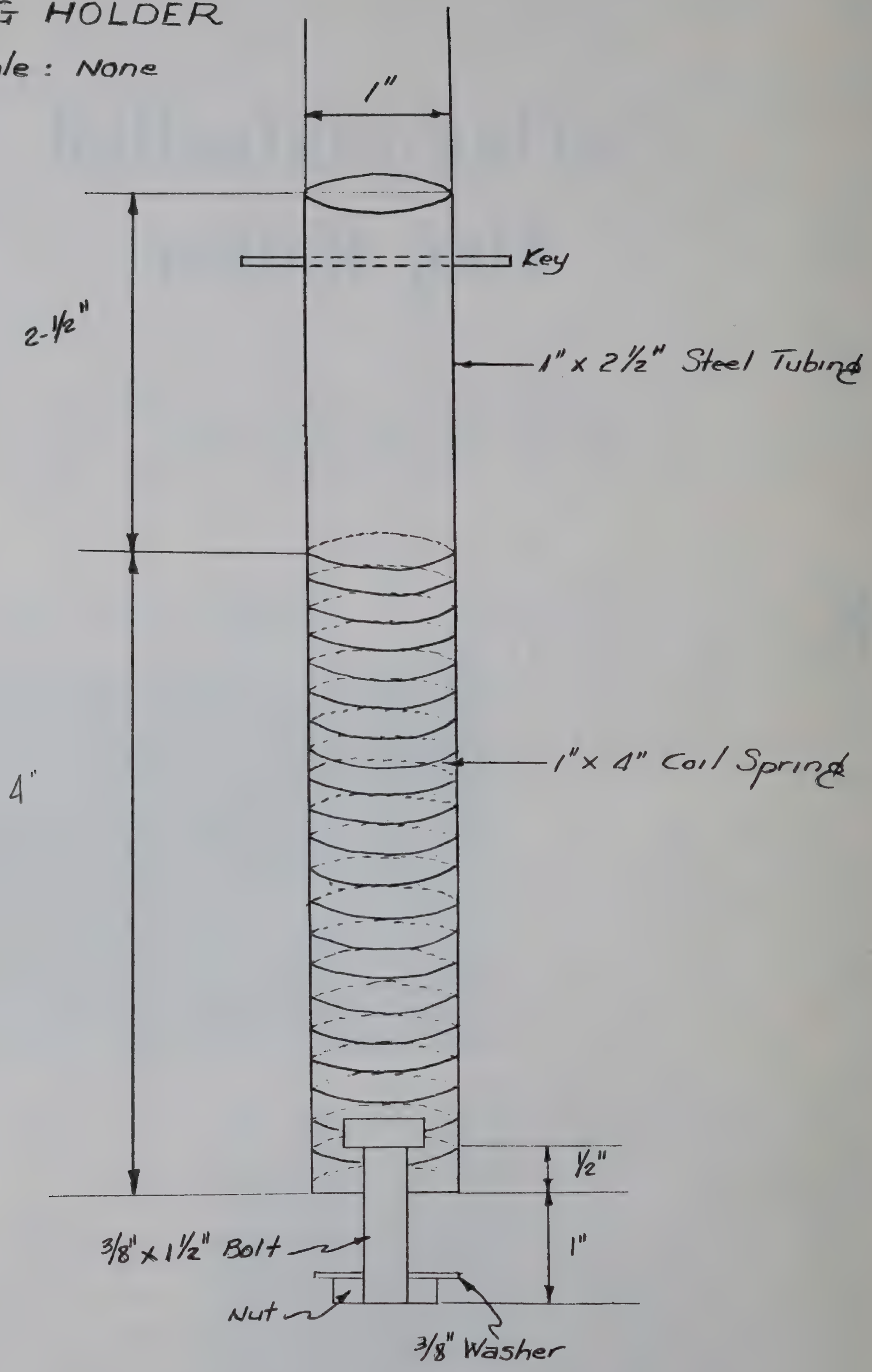
When making additional holders later, it was found necessary to use a small L-shaped bracket when the bolt could not be attached to the equipment in a verticle position. It should be noted here that a somewhat larger holder and spring than the one inch described would no doubt be satisfactory, but a smaller one is not thought advisable.

In addition to being suitable on machinery, the holder was also attached to a "Road Machinery Ahead" sign, with a hook arrangement for keeping the flag rolled up and out of the way on the sign when not in use.

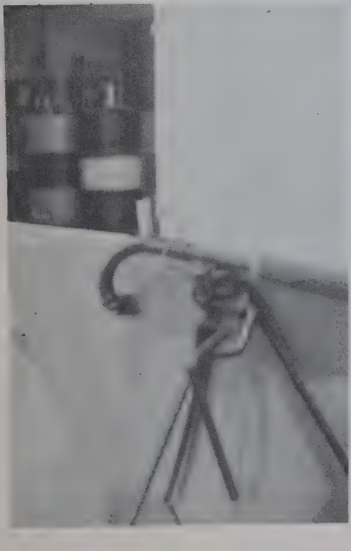
This flag holder has now been in use for several months and has proved to be very satisfactory. We believe it has provided a good solution to the problem.

SPRING - CONTROLLED FLAG HOLDER

Scale : None

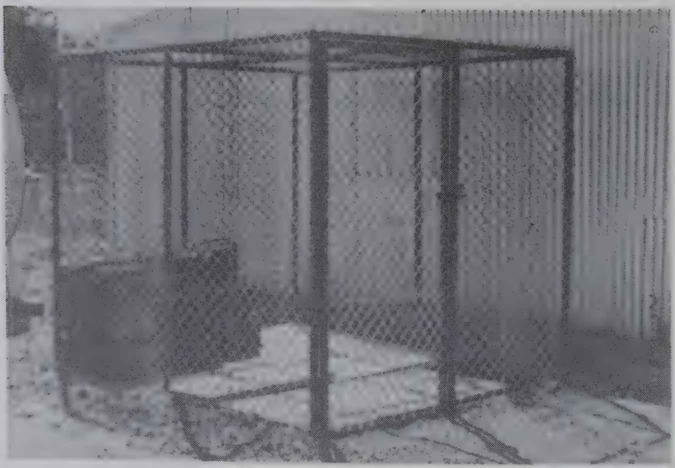


ROAD
MACHINERY
AHEAD



ABOUT THE DISTRICTS

CORRALLING BATTERIES IN DISTRICT 8



With old batteries selling for more than $2 each on the junk market, Mr. O. B. Seabourn, Equipment Supervisor of District 8, decided to make sure none of their old batteries strayed away.

DISTRICT 24 STORAGE TANK

E. W. Mars, District Engineer, stands beside a storage tank whose base has been enclosed, forming three compartments. District 24 has found these economical and practical. It provides water-proof storage space for housing all types of tools and accessories.

PLANTING IN DISTRICT 24

This Spanish Dagger was recently planted in District 24 on a newly graded section of U. S. 80 in Culberson County. They intend to plant several thousand of these next year, as grading progresses.

Freeways *

Herbert Eldridge, Chief Engineer of Planning

The 52nd Texas Legislature, by the enactment of House Bill 451, provides for the governing body of a City and the State Highway Commission to designate and construct freeways under certain conditions and limitations.

The act is in recognition of a need to provide safer highways and streets. The horrible toll of accidents on the highways and streets of this State and the Nation has reached such staggering totals that every serious-thinking American is demanding that measures be taken to reduce this unnecessary waste of life, limb, and property. It has long been recognized that safety can be brought about by strict adherence to the three E's, that is Engineering, Education, and Enforcement. The Highway Department has full responsibility for Engineering, and, in order to bring about a maximum of safety, must assist and coordinate with the responsible agencies on Education and Enforcement.

In our responsible field of Engineering we know that maximum safety can be accomplished only by the separation of opposing traffic lanes, by the separation of cross-traffic, and by the control of access and egress with adequately designed and constructed facilities for handling this incoming and outgoing traffic volume with the least interruption of free movement on the through traffic lanes.

Our Legislature is fully cognizant of the problem and of the necessity of laws to assist in bringing about an adequate solution. The freeway law has been provided to assist in accomplishing the engineering phases of the problem for adequate safety. It was a revolutionary step in that it subordinates a previously firmly-established right of direct access to that of indirect access for highway safety.

It will be contended that the law denies access. Our attitude in this respect will determine the success or failure of the law. I sincerely hope that our operations under the law will concede a right of access but that the access will be indirect or controlled. Highways are built with public funds and for public use. We should not want to deny use of the highway to adjacent property owners. We want them to use the highways but we want them to enter and leave the highway at designated locations designed for safe entry and exit. In accomplishing this objective we must be prepared to provide adequate frontage roads along the highway for use of property owners to the points of access. If we believe in this concept and if we diligently provide frontage roads as needed, we should have little difficulty in controlling access.

The freeway law, nor any other assist that the Legislature may enact, will not, in itself, assure control of access. We are sure to fail in obtaining controlled access if we use the law as an excuse for our own omissions such as lack of diligence or failure to respect the rights of citizens

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* Comments made to the Texas Highway Staff Meeting, June 19, 1952

in using a facility that his tax funds have bought. We can't afford to tell an adjacent property owner that he cannot enter the through highway lanes opposite his property unless we can show him a satisfactory road to use from his property to a point of access.

Where we can build the complete freeway facility in the initial construction there should be no difficulty in maintaining controlled access. This should be done in all metropolitan areas. Where we have intelligently planned and built I am confident that the Courts will uphold the desire of the people for highway safety.

Freeway designations will necessarily include many miles in rural areas where it is economically feasible to construct the through lanes only. This situation will present our principal difficulties of controlling access because we will be reluctant to recommend the building of several miles of frontage road just to serve one property owner. Yet this must be done to assure control of access. In this connection we advocate the grading of frontage roads in rural areas along with the construction of through lanes. This outlines the proposed facility to existing and prospective property owners. As development of adjacent property begins we add select material on the graded frontage road. As further development occurs we improve the frontage road to standards for adequate service. We must be diligent in providing these facilities if we are to prevent direct access to the through lanes.

It will be said that even after adequate frontage roads have been provided some drivers will cross direct from the frontage roads to the through lanes. It is to be expected that this will occur. We should use all reasonable design and construction measures to discourage this and use the facilities of Education and Enforcement for full accomplishment of the objective.

It is the policy of the Department that all right of way acquired for a freeway or controlled access highway shall include in the deeds the acquisition of access rights. This is a requirement of the law on existing highways that are designated as freeways. It is not a requirement of the law for new routes designated as freeways.

Many miles of freeways that have been and will be constructed in the near future are on rights of way that do not include in the deeds the acquisition of access rights. The width of acquired rights of way is adequate for ultimate freeway construction. We believe that it is economically unfeasible to renegotiate rights of way acquisition in these cases to include in the deeds the acquisition of access rights. We are taking a reasonable risk that our diligence in providing the needed facilities at the proper time will assure control of access. Yet we do not care to take this risk in the building of freeways where right of way has not yet been acquired.

In the case of an existing highway route in the metropolitan area of a large city, but outside its city limit, where there is extensive ribbon development, it is proposed to acquire all of the necessary additional right of way along one side. Should this additional right of way be acquired on the controlled access plan? The law and our policy give an affirmative answer. Should access rights be acquired on the side of the highway route where no additional right of way is required? The law and our policy also give an affirmative answer. One might question our unwillingness to take a risk in the latter case similar to the one we are taking in the building of freeways on previously acquired rights of way. The difference is that there was no freeway law applicable in one instance where there is in the other. Then isn't it still economically unfeasible to acquire access rights only? Not necessarily. The first case involves a renegotiation including property and land values where the latter case involves only access rights. When access rights are properly explained with well designed and carefully-prepared plans available to show to property owners, the cost of access rights should be nominal.

It will be recalled that the District Engineers and Engineer-Managers of the Department, through their answers to a questionnaire on the subject, outlined a policy that was approved by the Highway Commission. This policy recognizes that the building of a system of freeways is a long-time job; that the accomplishment will be expedited with the maximum use of present facilities; that the sequence should be in accordance with need which means that metropolitan areas should receive first consideration; that designations should not be made far in advance of construction; and that existing policies are applicable to freeway construction.

The freeway law and the Commission policy offer the engineers of the Department a challenge in long range planning. For the first time in our experience we can now establish a width of right of way to accommodate an ultimate facility. When the ultimate facility receives its traffic load it will not be increased in lane capacity but, instead, additional freeways will be planned and built. The width of right of way will vary according to the factors affecting width, such as lane capacity, terrain, safety measures, etc., but the factors should be given due consideration in establishing width because the width once established and right of way acquired should not be changed. The local government units and the public have become weary with our repeated requests for additional right of way on existing highway routes. Such additional right of way where side road development has taken place is expensive and disturbing economic influence. We should strive to avoid additional right of way requests on our proposed freeways by carefully determining width requirement.

We are learning that a railroad paralleling a highway does not assure controlled access. While it may eliminate the need for a frontage road, it does not eliminate access and our width determination should allow for the building of safe access where crossing of the railroad may be permitted.

Another important factor in width determination is the use that will be made of the existing pavement. If its eventual use will be that of a frontage road, which means that additional right of way would be acquired on one side, the total width will be increased over normal requirements.

In order to furnish understanding for long range planning the Highway Commission on several occasions has expressed intent for freeway designations. The declaration of intent furnishes the authority necessary for the State Highway Engineer to proceed with studies and investigations needed for determination of right of way requirements and the delivery of deeds to local government units. Upon the passage of the intent action of the Commission, copies of the action should be transmitted to the affected local government units with your appropriate comment. Further action regarding surveys and right of way determination would depend upon program or a request of the local government unit who may desire to proceed with right of way procurement.

In all phases of freeway studies and development you are urged to coordinate with the Road Design Division. It is extremely essential that our thinking and efforts be coordinated for development of an adequate system.

How does the Commission determine the highways or sections of highways for freeway designation or intent declaration? Studies are under way and will be continued for this determination. Highway sections having traffic volumes that presently justify four lane divided construction are eligible for consideration. A declaration of freeway intent may be made if (1) planning investigations are needed on a section for immediate future construction program, (2) additional right of way is needed for a currently proposed betterment, and (3) a county requests deeds for right of way procurement. For any of these reasons, and possibly others, you may request consideration of freeway intent.

* * *

SHADES OF THE PAST . . .

Cat. "60" and twelve foot Russell Grader – Bread and Butter equipment in 1930.

Latest model heavy duty motor grader – year 1930. Weight 12,000 pounds, powered with McCormick Deering 30 HP gasoline tractor with solid tires.

Bane of maintenance men in Robertson County in the early '30s was this gravity type distributor with a tendency to slop oil all over the countryside, including the operator.

"Comments From the Traveling Public"
OVER THE HIGHWAYS

. . . Would like to see traffic lights lowered. They're much too high and hard to see, especially if the car has a visor . . .

Fresno, California

. . . The black line dividing the highway is not as easily seen, especially at night. Use white lines for center on roads . . .

Los Angeles, California

. . . Highways are not built to take care of the amount of traffic there is in Texas . . .

Fremont, Nebraska

. . . Please mark EAST or WEST on all highway signs. We got lost in --- --- and when we got back on our route we went miles in the wrong direction . . .

Salem, New Jersey

. . . No elevation on curves. Not enough directions at road intersections. The poorest highway marking through cities of any state I have been through. Many so called "loops" not properly marked . . .

Dennis, Mississippi

. . . Sunken road shoulders should be improved - very dangerous when wheels go off roads . . .

Bridgeport, Connecticut

. . . We traveled in seven states on our vacation and Texas had the best highways, roadside parks, and highway markers of any of these . . .

Shreveport, Louisiana

. . . Highway markings on roads are not like other states. (Causes confusion), the one for passing especially . . .

Rochester, New Hampshire

This company contemplates producing furniture in your state. We are desirous of locating a satisfactory site in your state. . . Does one have to be a Democrat to locate in Texas?

(Signed)
East Palestine, Ohio

. . . Everyone says that Texas is a fine place so I'm planning to see it very soon. Are the Texas people friendly to strangers? If they aren't, please forget about the information I wanted . . .

(Signed)
Crivitz, Wisconsin

Mr. E. W. Mars
District Engineer
State Highway Department
Box 631
El Paso, Texas

While traveling over State 118 in the Davis Mountains area Sunday afternoon, July 13th, we encountered quite a heavy rainfall. The flash flood quickly overflowed the pavement in one of the canyons near Indian Lodge, rendering the road impassable.

As if by premonition, highway equipment and personnel quickly appeared upon the scene and, with the aid of bulldozers and skilled manpower, had the road open in a matter of minutes.

The men kept vigil over the highways in this area throughout the night and the following morning. When I again came over this section of road, I found three men engaged in removing debris and boulders in order that water could pass rapidly over the pavement without building up to a depth which made the highway impassable. The name of the man operating the bulldozer was Reinhart. He was assisted by two men whose names I did not understand.

The thing which impressed me most about this procedure was the fact that these men alerted themselves without any instructions or orders and impelled solely by a devotion to duty, separated themselves from their homes and diversions on Sunday afternoon and night, beyond the call of duty, in order to prevent inconvenience and suffering on the part of the traveling public. Characteristic examples of loyalty and dependability such as this on the part of the personnel of the Texas Highway Department lends added thrill and satisfaction to one privileged to be associated with this organization. I hope that it will be possible for you to extend thanks to Mr. Reinhart and his assistants for their unobtrusive discharge of what to them was routine duty but which to me was a splendid example of voluntary acceptance of responsibility in time of need.

Fred A. Wemple, Member
Texas Highway Commission
Midland, Texas